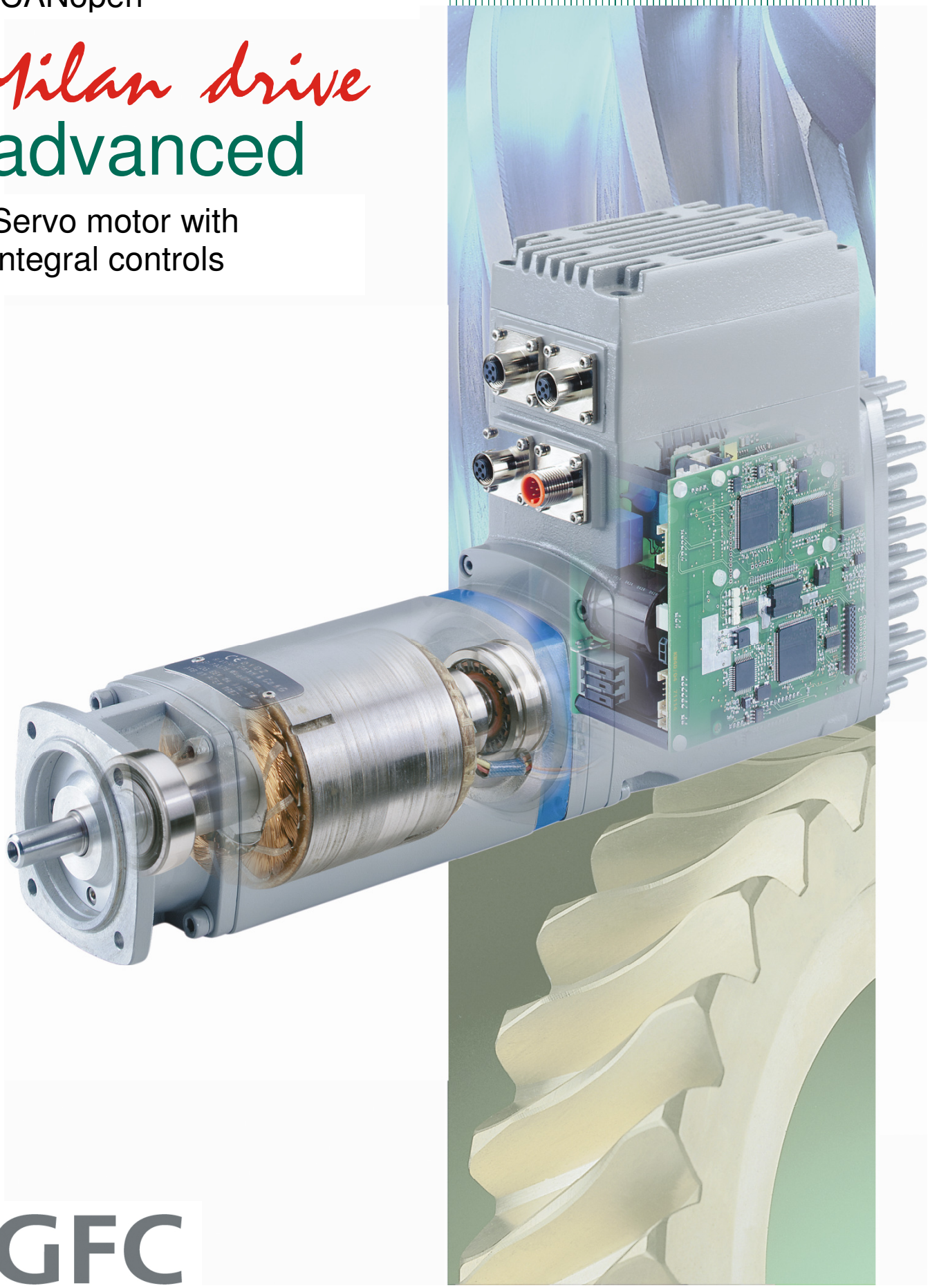
Interface description
CANopen

Milan drive advanced

Servo motor with
integral controls



GFC

Preface

Thoroughly read the present manual and all safety instructions and warnings in particular before installation and commissioning of the servo drive. Observe all warning plates attached to the device. Please make sure that all warning plates are legible and that missing or damaged signs are replaced.

The present user manual describes wiring, commissioning, functions and the protocol of the Milan Drive Advanced CANopen interface. It is part of the overall documentation of the servo drives with Milan Drive Advanced integral electronics.
For information on installation, commissioning and functions of the Milan Drive Advanced, please refer to the corresponding user manuals.
A list of these user manuals can be found in the literature section.

For more detailed information refer to:

Website
For technical and general information, customers may refer to the following address:
http://www.milan-drive.de

Contact
In case you have any questions or problems when reading these operating instructions, please contact one of the addresses mentioned at the end of these instructions or the sales agent responsible for your area.

Possibly other functions may be available which are not described in this document. However, the manufacturer shall not be obliged to provide these functions with a new drive or when performing maintenance work.
The contents of this document were checked for compliance with the described hardware and software. Deviations may nevertheless occur; we assume no liability for full compliance with all data. The information contained in these documents is subject to regular revision and any required modification will be included in the next issue.

We reserve the right to alter the present document without prior notification.

Issue	Note
1.05	First Issue
1.06	General update
1.09	Update due to functional extension with firmware APP 02.00
2.09	General update

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1 Safety instructions

1.1 Designated use

Milan Drive Advanced servo drives, also called ***MDA*** in the following, are designed as equipment for the use in industrial environments. As standard, the servo drives are designed for installation in industrial robots, pick and place units, and many other equipment and devices. For other applications, please consult us. The manufacturer is not liable for any damage resulting from use in other than the designated applications. Such risk lies entirely with the user. Observance of these operation instructions is considered as part of the servo drive's designated use.
Please read these instructions thoroughly as they are intended for your personal safety and also help enhancing the lifetime of your servo drive.

1.2 General notes

- During operation, parts move or rotate within this unit. Important dangers can arise from rotating shaft couplings with keyway and inserted parallel key. Remove inserted parallel keys or protect them against loosening by taking suitable measures.
- During operation, surfaces of the drive unit may heat up according to its enclosure protection. The surface temperature can rise to above 100 °C. Before touching the unit, measure the temperature for safety reasons; if required, wait until it has cooled down to 40 °C.

1.3 Warnings and notes

Failure to observe the warnings and notes may lead to serious injuries or damage. Qualified personnel must be thoroughly familiar with all warnings and notes in these operation instructions.
In order to highlight safety-relevant procedures in these operation instructions, the following safety instructions apply:

DANGER indicates an imminently hazardous situation, which – if the warnings and notes are not observed – could result in **death** or **serious damage to health** or **considerable material damage**. This note is only used in case of **danger to life** and a high level of hazard.

Danger sign on the type of danger and/ or pictograph on consequences, measures, or prohibitions	**DANGER**
	Type of hazard and its source **Possible consequence(s) on non-observance** → Measure(s) to avoid the hazard.

WARNING indicates a potentially hazardous situation, which – if the warnings and notes are not observed – could result in **death** or **serious damage to health** or **considerable material damage**.

Danger sign on the type of danger and/ or pictograph on consequences, measures, or prohibitions	**WARNING**
	Type of hazard and its source **Possible consequence(s) on non-observance** → Measure(s) to avoid the hazard.

CAUTION indicates a potentially hazardous situation, which – if the warnings and notes are not observed – could result in **minor injuries** or **material damage**.

Danger sign on the type of danger and/ or pictograph on consequences, measures, or prohibitions	**CAUTION**
	Type of hazard and its source **Possible consequence(s) on non-observance** → Measure(s) to avoid the hazard.

NOTE contains important information on the product or highlights a section of the documentation to which special attention should be paid.

Pictograph on consequences or measures	**NOTE**
	Type of hazard and its source **Possible consequence(s) on non-observance** → Measure(s) to avoid the hazard.

1.3.1 Used danger signs

Danger signs warn about a danger source.
Layout: yellow triangle and symbol.

General danger zone in combination with personal injuries!
Please heed all measures marked with the danger sign to prevent injuries or damage.

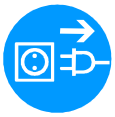
Hazardous electrical voltage!
Danger due to electric shock.

Hot surfaces
Danger of burns.

1.3.2 Used mandatory signs

Mandatory signs call on the user to do something to prevent a danger.
Layout: blue circle and symbol.

General mandatory sign
Heed instruction.



Caution
Disconnect plug before opening.

1.3.3 Further symbols

Information
Contains important tips and information. In case of non-observance, no damage is to be expected.

1.4 Commissioning (electrical connection)

	NOTE
	For the Milan Drive Advanced servo drive, the motor and the controls are firmly connected as a unit. → Proceed in compliance with the indications in the “RS 232 Firmware” user manual for assembly, installation and commissioning.

2 Short description

For the **Milan Drive Advanced** servo drive, the motor and the controls are firmly connected as a unit. In the standard version, the electrical connections are established via standardised signal (M12) and power plug/socket connectors (M23).

Motor:
The ***MES*** servo motors are three-phase synchronous motors with special permanent magnets. Permanent ambient temperatures up to 155 °C (insulation class F) are permitted. The motor temperature is monitored by a sensor integrated in the motor winding. As an option, the motor is also available with integral holding brake.

Electronics:
The ***DAC*** servo controls combine all components necessary for independent electronic controls in one housing. These are:

- a self-commutated intermediate circuit including a mains filter for direct connection to the mains,
- 4 quadrant operation (integral brake resistor)
- integral voltage supply for electronics
- sequence control and motor control
- fieldbus interfaces Profibus DP, CANopen (option)
- digital galvanically isolated inputs and outputs
- analogue input (option)
- RS232 interface for operation and programming.

Therefore, the **Milan Drive Advanced** may be operated independently for various drive solutions or may also be integrated in automation systems.

3 CANopen

3.1 Basic information on the CANopen interface of the MDA

The ***Milan Drive Advanced*** CANopen interface is based on the CANopen communication profile DS 301 and the "CANopen Device Profile for Drives and Motion Control“ CiA **D**raft **S**tandard **P**roposal **402**. The max. transmission speed is 1 Mbit/s.
The MDA interface can be set to the following baud rates:
10, 20, 50, 100, 125, 250, 500kBaud, 1MBaud

DSP 402 profile

The DSP 402 profile is standard for all manufacturers building drives with CANopen interface. The profile determines how drives are programmed and how the nominal and actual values are transmitted. This makes it possible to interchange drives of different manufacturers. The profile contains specifications for the operation mode "Speed control" and "Positioning". It determines the basic drive functions and leaves room for user-specific expansions and developments.

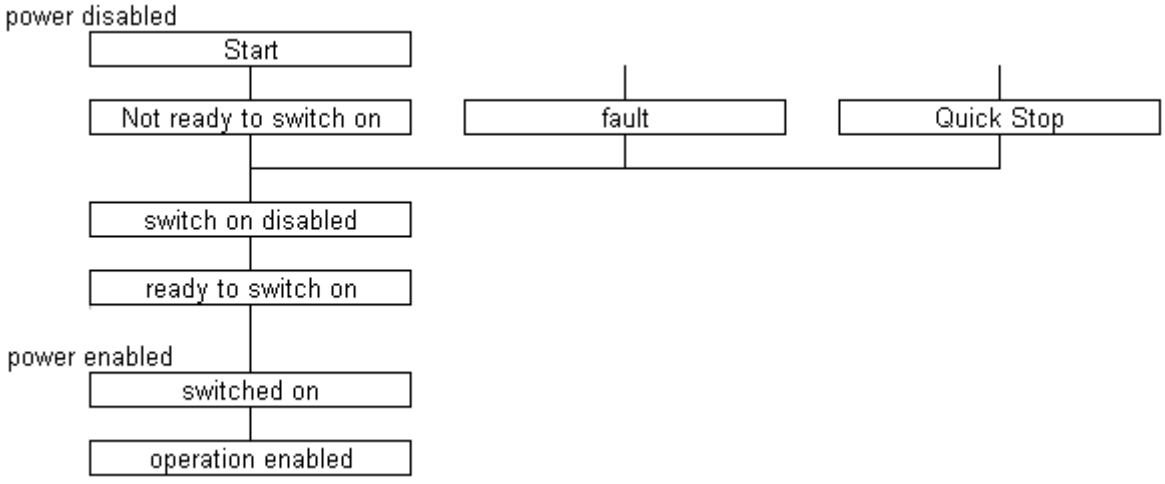
3.2 Functions of the CANopen interface of the MDA

- Reading and programming the parameters and driving data records
- Executing drive tasks
- Reference operation
- Reading actual values, faults, and warnings
- Logging parameter and driving data record changes

3.3 Description of the state machine

The CANopen state machine (see section 10 of the DSP 402 "Device Profile for Drives and Motion Control“) is started up depending on the bit changes in the control word and status changes in the application.
Control and parameter change rights are controlled by bit 15 of the control word. Level 4 (Planner) is set for the write access to parameters.
One of the following operation modes can be selected in the 'Switch-On-Disabled, Ready-To-Switch-On, Switched-On and Operation-Enable' states. The run commands are executed in the 'Operation-Enable' state within this operation mode.

3.3.1 Function diagram for basic controller



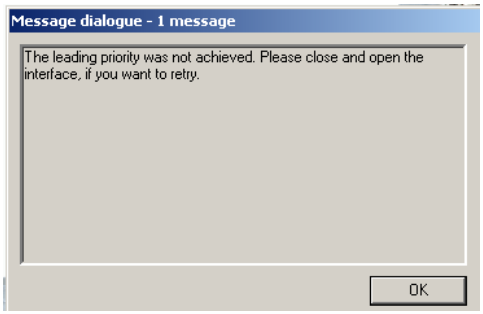
The illustration above shows the outlines of the state machine. For the signal sequence required to control the state machine, refer to the CANopen Draft Standard Proposal DSP 402 or to the examples in section 7 "Examples".

3.3.2 Control and parameter change rights (remote)

For CANopen, a priority (remote) is administered. This priority can be assigned to various users.

To operate and program the MDA via the bus master, the bus master must have priority rights. Thus, priority is automatically taken over from the bus master by correct state machine start-up of the drive via the control word.
If the priority is already with another user at the start-up of state machine by the bus master, the MDA remains in state “not ready for operation”. The other operator (generally MDAwin) must first hand over priority before it can be called again via CANopen.

To enable access to an MDA via the MDAwin operating software, the respective priority must be available. If applicable, the priority must be abandoned by the bus master first. If the operating software cannot obtain a priority, it will signal each missing priority by opening an information window:


Message dialogue - 1 message
The leading priority was not achieved. Please close and open the interface, if you want to retry.
OK

3.3.3 6040h control word

For CANopen, the individual bits are assigned to different functions, depending on the respective type of duty. The generally valid functions are shown hereafter. Please refer to the respective operation mode chapter for the significations of the various operation modes.

Bit	Meaning
0	switch_on
1	enable_voltage
2	quick_stop
3	enable_operation
4 5 6	operation mode specific
7	reset_fault
8	stop
9 10	reserved
11 12 13 14	operation mode specific
15	Remote request

3.3.4 6041h status word

For CANopen, the individual bits are assigned to different functions, depending on the respective type of duty. The generally valid functions are shown hereafter. Please refer to the respective operation mode chapter for the significations of the various operation modes.

Bit	Meaning
0	ready_to_switch_on
1	switched_on
2	operation_enabled
3	fault
4	voltage_enabled
5	quick_stop
6	switch_on_disabled
7	warning
8	halt active (not on reference operation)
9	remote
10	target_reached (not on reference operation)
11	internal_limit_active
12 13	operation mode specific
14 15	reserved

3.4 Operation modes

The MDA allows selection between several types of control. They are included within the driving data records (DDR). To perform these control types, predefined operation modes have to be used in accordance with CANopen DSP 402.

The operation mode is determined by index 6060h. The current status is shown in index 6061h. The following operation modes are currently supported:

Value	hex	Operation mode
		CANopen-specific
0	00	None
1	01	Position control (profile position)
3	03	Speed control (profile velocity)
4	04	Torque control (profile torque)
6	06	Reference operation (homing)
		Manufacturer-specific
-7	F9	Manual operation
-8	F8	Driving data record operation

Operations are always performed depending on the driving data records. Either a driving data record is generated on the basis of device-specific indices; this is the case in operation modes 1 to 3, whereas the index contents are mapped and used in **driving data record 0**. Or a driving data record from the device-specific parameter numbers (manufacturer profile) is directly used in operation mode –8. The driving data record number can be indicated via the control word or the contents of index 2100 h current driving data record number (Driving_Program-Number).

For a CANopen driving data record, the controller settings are transmitted via one of the four speed position controller parameter (indices 2600h to 2603 h), whereas the values from the indices 60FBh (position_control), 6065h (slippage_error_window) and 6067h position window are entered.

3.4.1 Changing the operation mode

The operation mode is determined by index 6060h. The current status is shown in index 6061h.
Index 6060h can be mapped into the PDOs and thus the operation mode can be modified either via PDO and/or via SDO communication.

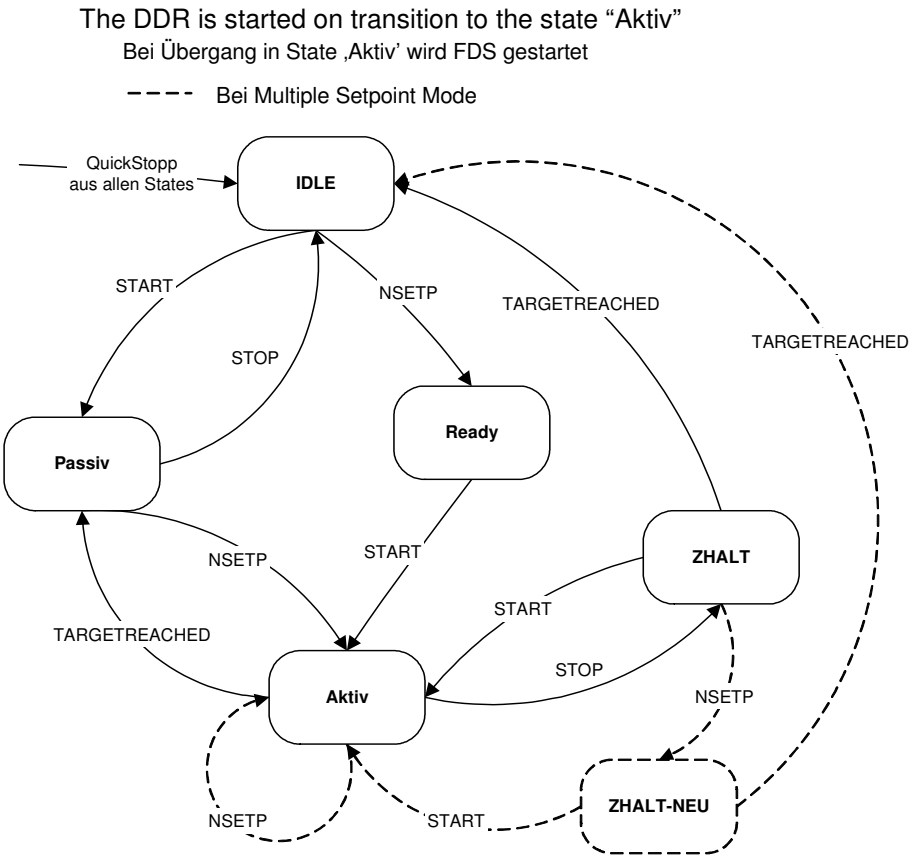
In the following states “Switch-On-Disabled, Ready-To-Switch-On, Switched-On and Operation-Enable“ one of the operation modes (during which drive commands in state “Operation-Enable“ can be performed) can be selected, as described hereafter.

3.4.2 Position control operation mode (Profile position mode)

The drive executes a position-controlled driving data record (DDR). The indices are represented via the driving data record 0 and the speed position controller, controller record 4 (index 2603 h).

3.4.2.1 State machine for position control

In addition to the state machine (as described in chapter “Workflow of basic control”) the state machine as described below is used to control the drive in positioning control operation mode.



State machine profile position mode

START / STOP	Control word Bit 8 halt
NSETP	Control word Bit 4 new setpoint
TARGETREACHED	Status word Bit 10 target reached

IDLE	idle state
PASSIV, READY	transitions
ZHALT	intermediate stop
ZHALT-NEU	intermediate stop in multiple setpoint mode

3.4.2.2 Operation-mode specific bits in the control word:

Bit	Value	Meaning	Remarks
0	1	switch on	
	0		
1	1	enable voltage	
	0		
2	1	quick stop	
	0		
3	1	enable operation	
	0		
4	1	new setpoint	Accept new setpoint
	0		
5	1	Change set immediately	Complete active positioning operation, then start next positioning operation
	0		Abort active positioning operation, then start next positioning operation
6	1	abs_rel	Setpoint is relative
	0		Setpoint is absolute
7	1	reset fault	
	0		
8	1	halt	
	0		
9 10 11 12 13 14		reserved	
15	1	remote request	
	0		

3.4.2.3 Input values:

Mandatory

Index	Name	Byte	Mapping
6060	Modes_of_operation	2	Yes
607A	target position	4	Yes
6081	profile velocity	4	Yes

Optional

Index	Name	Byte	Mapping
6072	max torque	2	Yes
6083	profile acceleration	4	Yes
6084	profile deceleration	4	Yes
6086	motion profile type	2	Yes
60FB	position control parameter set	Array	

3.4.2.4 Operation-mode specific bits in the status word:

Bit	Value	Meaning	Remarks
0	1	ready to switch on	
	0		
1	1	switched on	
	0		
2	1	operation enabled	
	0		
3	1	fault	
	0		
4	1	voltage enabled	
	0		
5	1	quick stop	
	0		
6	1	switch on disabled	
	0		
7	1	warning	
	0		
8	1	halt active	
	0		
9	1	remote	
	0		
10	1	target reached	
	0		
11	1	internal limit active	
	0		
12	1	setpoint acknowledge	
	0		
13	1	following error	
	0		
14 15		reserved	

3.4.2.5 Output values:

Index	Name	Byte	Mapping
6064	position actual value	4	Yes
606C	velocity actual value	4	Yes
6077	torque actual value	4	Yes

3.4.3 Speed control operation mode (Profile velocity mode)

The drive executes a speed-controlled driving data record (DDR). The indices are represented via driving data record 0 and the speed position controller, controller record 4 (index 2603 h).

3.4.3.1 Operation-mode specific bits in the control word:

Bit	Value	Meaning	Remarks
0	1	switch on	
	0		
1	1	enable voltage	
	0		
2	1	quick stop	
	0		
3	1	enable operation	
	0		
4 5 6	1	reserved	
	0		
7	1	reset fault	
	0		
8	1	halt	
	0		
9 10 11 12 13 14		reserved	
15	1	remote request	
	0		

3.4.3.2 Input values:

Mandatory

Index	Name	Byte	Mapping
6060	modes of operation	2	Yes
60FF	target velocity	4	Yes

Optional

Index	Name	Byte	Mapping
6072	max torque	2	
6083	profile acceleration	4	
6084	profile deceleration	4	
6086	motion profile type	2	
60FB	position control parameter set	Array	

3.4.3.3 Operation-mode specific bits in the status word:

Bit	Value	Meaning	Remarks
0	1	ready to switch on	
	0		
1	1	switched on	
	0		
2	1	operation enabled	
	0		
3	1	fault	
	0		
4	1	voltage enabled	
	0		
5	1	quick stop	
	0		
6	1	switch on disabled	
	0		
7	1	warning	
	0		
8	1	halt active	
	0		
9	1	remote	
	0		
10	1	target reached	
	0		
11	1	internal limit active	
	0		
12	1	Speed	
	0		
13	1	Max slippage error	
	0		
14 15		reserved	

3.4.3.4 Output values:

Index	Name	Byte	Mapping
6064	position actual value	4	Yes
606C	velocity actual value	4	Yes
6077	torque actual value	4	Yes

NOTE

During operation, the setpoints should only be modified within the maximum values. If a new setpoint exceeds a maximum value, the new setpoint is rejected without fault signal and the previous setpoint is used.

In turn, during start-up the setpoint is compared to the maximum values and, if applicable, the maximum value is specified as setpoint.

Example: Setpoint in the moment of starting: 4000 rpm
Maximum velocity: 3000 rpm
Reaction: The setpoint is set to the maximum velocity: 3000 rpm

New setpoint during operation: 4000 rpm
Maximum velocity: 3000 rpm
Previous setpoint: 1000 rpm
Reaction: The previous setpoint 1.000 rpm is held without error message; the new setpoint will not be accepted because it exceeds the limits.

3.4.4 Torque control operation mode (Profile torque mode)

The drive executes a torque-controlled driving data record (DDR). The indices are represented via driving data record 0 and the speed position controller, controller record 4 (index 2603 h).

3.4.4.1 Operation-mode specific bits in the control word:

Bit	Value	Meaning	Remarks
0	1	switch on	
	0		
1	1	enable voltage	
	0		
2	1	quick stop	
	0		
3	1	enable operation	
	0		
4 5 6	1	reserved	
	0		
7	1	reset fault	
	0		
8	1	halt	
	0		
9 10 11 12 13 14		reserved	
15	1	remote request	
	0		

3.4.4.2 Input values:

Mandatory

Index	Name	Byte	Mapping
6060	modes of operation	2	Yes
6071	target torque	2	Yes

Optional

Index	Name	Byte	Mapping
607F	max profile velocity	2	
6083	profile acceleration	4	
6084	profile deceleration	4	
6086	motion profile type	2	
60FB	position control parameter set	Array	

3.4.4.3 Operation-mode specific bits in the status word:

Bit	Value	Meaning	Remarks
0	1	ready to switch on	
	0		
1	1	switched on	
	0		
2	1	operation enabled	
	0		
3	1	fault	
	0		
4	1	voltage enabled	
	0		
5	1	quick stop	
	0		
6	1	switch on disabled	
	0		
7	1	warning	
	0		
8	1	halt active	
	0		
9	1	remote	
	0		
10	1	target reached	
	0		
11	1	internal limit active	
	0		
12	1	Speed	
	0		
13 14 15		reserved	

3.4.4.4 Output values:

Index	Name	Byte	Mapping
6064	position actual value	4	Yes
606C	velocity actual value	4	Yes
6077	torque actual value	4	Yes

3.4.5 Reference operation mode (Homing Mode)

The drive performs a reference operation. The settings of the parameters (index 2105 H reference operation parameter) are used. The reference type and speed can be overwritten by the standard CANopen indices (homing_method and homing_speeds).
Only one speed is used for approaching and passing the reference point (homing_speed, subindex 1).
Seven different reference operation types are available in the ***MDA*** reference operation management. They are shown in CANopen in combination with the reference setting "Passing direction' as indicated below.

3.4.5.1 Reference operation types

CANopen Standard:		Reference operation type	Passing direction
35	23h	None	None
23-26 27-30	17h – 1Ah 1Bh – 1Eh	Marker	negative positive
19 20	13h 14h	Flank	negative positive
2, 18	2h, 12h	Limit switch positive	(cannot be set, negative)
1, 17	1h, 11h	Limit switch negative	(cannot be set, positive)
Manufacturer-specific		**Reference operation type**	**Passing direction**
-1	FFh	No reference operation, reference is set to the value entered in the reference offset.	None
-2	FEh	Reference memory, reference bit and actual position are restored from the memory.	None

3.4.5.2 Operation mode-specific bits in the control word:

Bit	Value	Meaning	Remarks
0	1	switch on	
	0		
1	1	enable voltage	
	0		
2	1	quick stop	
	0		
3	1	enable operation	
	0		
4		Homing operation start	
5	1	reserved	
6	0		
7	1	reset fault	
	0		
8 9 10 11 12 13 14		reserved	
15	1	remote request	
	0		

3.4.5.3 Input values:

Mandatory

Index	Name	Byte	Mapping
6060	modes of operation	2	Yes

Optional

Index	Name	Byte	Mapping
607C	home offset	4	
6098	homing method	2	
6099	homing speeds	Array	
609A	homing acceleration		

Or MDA-specific

2105	Reference operation	Array	No

3.4.5.4 Operation mode-specific bits in the status word:

Bit	Value	Meaning	Remarks
0	1	ready to switch on	
	0		
1	1	switched on	
	0		
2	1	operation enabled	
	0		
3	1	fault	
	0		
4	1	voltage enabled	
	0		
5	1	quick stop	
	0		
6	1	switch on disabled	
	0		
7	1	warning	
	0		
8		reserved	
9	1	remote	
	0		
10	1	Homing active	
	0		
11	1	Internal limit active	
	0		
12	1	Homing attained	
	0		
13		Homing error	
14 15		reserved	

3.4.5.5 Output values:

Index	Name	Byte	Mapping
6064	position actual value	4	Yes
606C	velocity actual value	4	Yes
6077	torque actual value	4	Yes

3.4.6 Manual operation mode

The drive moves in the manual operation to a predefined driving data record. Two separate driving data records are available for manual operation (index 2108 / 2109H manual operation driving data record), which may be programmed irrespective of the driving program.

3.4.6.1 Operation-mode specific bits in the control word:

Bit	Value	Meaning	Remarks
0	1	switch on	
	0		
1	1	enable voltage	
	0		
2	1	quick stop	
	0		
3	1	enable operation	
	0		
4		Manual operation selection	Manual operation driving data record 1
			Manual operation driving data record 2
5	1	reserved	
6	0		
7	1	reset fault	
	0		
8		Halt	
9 10 11 12 13 14		reserved	
15	1	remote request	
	0		

3.4.6.2 Input values:

Mandatory

Index	Name	Byte	Mapping
6060	modes of operation	2	Yes

Optional

Index	Name	Byte	Mapping
2108	Manual operation driving data record 1	Array	No
2109	Manual operation driving data record 2	Array	No

3.4.6.3 Operation-mode specific bits in the status word:

Bit	Value	Meaning	Remarks
0	1	ready to switch on	
	0		
1	1	switched on	
	0		
2	1	operation enabled	
	0		
3	1	fault	
	0		
4	1	voltage enabled	
	0		
5	1	quick stop	
	0		
6	1	switch on disabled	
	0		
7	1	warning	
	0		
8	1	halt active	
	0		
9	1	remote	
	0		
10	1	target reached	
	0		
11	1	internal limit active	
	0		
12	1	Manual operation active	
	0		
13 14 15		reserved	

3.4.6.4 Output values:

Index	Name	Byte	Mapping
6064	position actual value	4	Yes
606C	velocity actual value	4	Yes
6077	torque actual value	4	Yes

3.4.7 Driving data record operation mode

The drive executes a driving data record (DDR). The controller type is determined by the setting in the driving data record. The driving data record number is retrieved from the control word (if DDR > 0), or from the parameters (index 2100h driving data record number > 0). A driving data record number between 1 and 99 is valid.

3.4.7.1 Operation mode-specific bits in the control word:

Bit	Value	Meaning	Remarks
0	1	switch on	
	0		
1	1	enable voltage	
	0		
2	1	quick stop	
	0		
3	1	enable operation	
	0		
4 5 6	1	reserved	
	0		
7	1	reset fault	
	0		
8	1	halt	
	0		
9 10		reserved	
11 12 13 14		DDR no.	DDR no. from Index 2100, if Value = 0 DDR no. valid, if 1 < Value < 15 (Eh)
15	1	remote request	
	0		

3.4.7.2 Input values:

Mandatory

Index	Name	Byte	Mapping
6060	modes of operation	2	Yes

Optional

Index	Name	Byte	Mapping
2100	Driving data record number	Array	No
27xx	Driving data records	Array	No

3.4.7.3 Operation mode-specific bits in the status word:

Bit	Value	Meaning	Remarks
0	1	ready to switch on	
	0		
1	1	switched on	
	0		
2	1	operation enabled	
	0		
3	1	fault	
	0		
4	1	voltage enabled	
	0		
5	1	quick stop	
	0		
6	1	switch on disabled	
	0		
7	1	warning	
	0		
8	1	halt active	
	0		
9	1	remote	
	0		
10	1	target reached	
	0		
11	1	internal limit active	
	0		
12	1	Speed	
	0		
13 14 15		reserved	

3.4.7.4 Output values:

Index	Name	Byte	Mapping
6064	position actual value	4	Yes
606C	velocity actual value	4	Yes
6077	torque actual value	4	Yes

3.5 Communication

Communication with the ***MDA*** is performed via CANopen communication profile DS 301. The max. transmission speed is 1 Mbit/s. A standardised CANopen cable and an active termination on both sides of the bus cable are imperatively required.

A CANopen cycle time of 3 ms is implemented in the system, which results in a continuous load of a telegram every 3 ms. Short peaks (10 telegrams per 3 ms) are compensated by a buffer.

Data is transmitted via telegrams (data frames) with a maximum of 8 byte data (maximum of 4 byte process date) and via request telegrams (remote frame). Larger data quantities are transferred using several telegrams.
Such a telegram consists of the parts:

SOM	COB ID	RTR	CTRL	Data	CRC	ACK	EOM

Start of message
COB identifier (11 bit)
Remote Transmission Request
Control Field
Data field with 0 to 8 byte
Checksum
Acknowledge
End of message

3.5.1 Structure of the COB ID

The module ID (bits 0 to 6) is used to indicate the node number which is shown in the "Fieldbus" window in the MDAwin operating software.
The function code (bit 7 to 10) is used to indicate the communication object.

10	9	8	7	6	5	4	3	2	1	0
Function Code				Module ID						

Broadcast objects

Object	Function Code	COB-ID
NMT	0000	0h
SYNC	0001	80h
TIME	0010	100h

Peer to Peer objects

Object	Function Code	COB-ID	communication	mapping
EMERGENCY	0001	81h .. FFh		
TX PDO 1	0011	181h .. 1FFh	1800h	1A00h
RX PDO 1	0100	201h .. 27Fh	1400h	1600h
TX PDO 2	0101	281h .. 2FFh	1801h	1A01h
RX PDO 2	0110	301h .. 37Fh	1401h	1601h
TX PDO 3	0111	381h .. 3FhF	1802h	1A02h
RX PDO 3	1000	401h .. 47Fh	1402h	1602h
RX PDO 4	1001	501h .. 57Fh	1403h	1603h
TX SDO	1011	581h .. 5FFh		
RX SDO	1100	601h .. 67Fh		
Nodeguard		701h .. 77Fh		

3.5.2 Network management object (NMT)

The network management processes the basic communication with the slave nodes. An NMT telegram contains the COB ID 0, a command specifier and the node address in the first data byte (refer to telegram structure).

The MDA responds to the following command specifiers (CS):

CS	Meaning
01h	starts a slave node and enables the PDOs.
02h	stops a slave node
80h	enter preoperational
81h	resets the communication stack of a slave node
82h	reset communication

3.5.3 Process data object PDO

PDOs are used for real-time data exchange with the ***MDA***. The ***MDA*** uses three TX-PDOs (***MDA*** → client) and four RX-PDOs (client → ***MDA***). The ***MDA*** supports dynamic mapping; the following mapping is set as default:

TX-PDO

		Byte							
		1	2	3	4	5	6	7	8
Tx-PDO1	1A00h	SW	SW						
Tx-PDO2	1A01h	MOO							
Tx-PDO3	1A02h	VEL	VEL	VEL	VEL	POS	POS	POS	POS

SW status word 6041h
MOO operation mode (modes_of_operation_display) 6061h
VEL actual speed (velocity_actual_value) 606Ch
POS actual position (position_actual_value) 6064h

RX-PDO

		Byte							
		1	2	3	4	5	6	7	8
Rx-PDO1	1600h	CW	CW						
Rx-PDO2	1601h	MOO							
Rx-PDO3	1602h	VEL	VEL	VEL	VEL				
Rx-PDO4	1603h	POS	POS	POS	POS				

CW control word 6040h
MOO operation mode (modes_of_operation) 6060h
VEL nominal output speed (target_velocity) 60FFh
POS nominal position (target_position) 607Ah

To change the mapping, delete the default settings first. This is realised by overwriting the sub-index 0 of the object concerned by the value 0. For more detailed information, please refer to CiA DS 301.

3.5.3.1 Changing the PDO mapping

To change the presetted mapping the PDO concerned has to be deactivated first. The PDO can be deactivated by writing 0 into the subindex 0 of the PDO concerned. Thereafter the new objects can be mapped into the PDO.
For further information refer to the CiA DS 301.
For an example of changing the PDO mapping refer to the chapter examples.

Deactivating the PDO

The presetted PDO mapping will be deactivated by writing the value 0 into the Subindex 0 (1 Byte) of the concerning PDO.

Setting new Objects

Each PDO can contain several objects up to a total length of 8 bytes. Each object is described by its index and data length; when mapping a new object, this information has to be written in the subindex concerned of the PDO.

Object data length	Function code
4 Bytes	20
2 Bytes	10
1 Bytes	08

Depending on the data length of the objects, the number of objects in the PDO can vary.

Activating the mapping

The new mapping will be activate by writing the number of Subindices used into the Subindex 0 of the concerning PDO.

Proceed as described in Index 1010h „Store Parameters“ to save the changed PDO mapping permanently.

3.5.4 Service data object SDO

A confirmed service is used to access the object directory of the ***MDA*** via SDO data exchange. An object consists of an index and a subindex.
The eight data bytes in a CAN telegram are structured as follows:

Byte	1	2	3	4	5	6	7	8
Meaning	command byte	index	index	subindex	data	data	data	data

The task IDs are transmitted via the command bytes. For the present confirmed service, the MDA responds with a response ID. In case of a negative response ID, the process data bytes contain a fault number; in case of a positive acknowledgment, the process data bytes are empty.

Task ID (command byte) (master → slave)

Bit	7	6	5	4	3	2	1	0
Meaning	ccs	ccs	ccs		n	n	e	s

Table Task IDs (master -> slave)

hex	bin	No. of data bytes	Description
22_h	0010 0010	not indicated	Write data (initiate SDO download request)
23_h	0010 0011	4	
$2B_h$	0010 1011	2	
$2F_h$	0010 1111	1	
40_h	0100 0000	all data	Read data (initiate SDO upload request)

Response ID (command byte) (slave → master)

Bit	7	6	5	4	3	2	1	0
Meaning	scs	scs	scs					

Table Response IDs (slave -> master)

hex	bin	No. of data bytes	Description
42_h	0100 0010	not indicated	Read data (initiate SDO download response)
43_h	0100 0011	4	
$4B_h$	0100 1011	2	
$4F_h$	0100 1111	1	
60_h	0110 0000	all data	Write data (initiate SDO upload response)
80_h	1000 0000	4 byte abort code	Fault (abort transfer request)

In addition to the fault numbers specified in CANopen, other drive-specific fault numbers are listed below. For the CANopen fault numbers, refer to the DSP 402.

Table Fault numbers for negative response ID

hex	Description
0601-0000	R/W attribute incorrect (unsupported access)
0602-0000	Object does not exist within the object directory
0607-0012	Data type not suitable
0607-0013	Data type does not exist (no object)
0609-0010	Index invalid (no object)
0609-0011	Subindex invalid (no subindex)
0609-0030	Upper or lower limit exceeded (range exceeded)

For a complete list of the fault codes refer to CiA DS 301.

3.6 Programming the master sub-assembly

3.6.1 Configuration of the controls

To set the bus address, use the "Fieldbus" window in the ***MDAwin*** operating software.

3.6.2 Functional blocks

Functional blocks for TwinCAT are available for the bus communication of the ***MDA*** with a Beckhoff BX5100. When using these blocks, the bus communication does not have to be programmed as the functional blocks may be integrated in existing applications.
The "CANopen PLC functional blocks" user manual contains the description of the individual functional blocks.

4 Parameters

4.1 List of the parameter numbers

The parameter range of the CANopen interface is divided into three subranges. These are as follows

1000h to 1FFFh profile area
2000h to 5FFFh manufacturer specific area
6000h to 8FFFh CANopen device area

The fields shaded in grey are reserved for use at a later date and may currently not be called up via CANopen.

Index	Object	Description	Bytes	Mapping
0000h 0FFFh		Reserved for CANopen		

1000h	VAR	Device type	4	No
1001h	VAR	Error register	1	Yes
1002h		Not used		No
1003h	ARRAY	Predefined error field		No
1004h		Not used		
1005h	VAR	COB ID Sync	4	No
1006h 1007h		Not used		
1008h	STRING	Manufacturer device name		No
1009h	STRING	Manufacturer hardware name		No
100Ah	STRING	Manufacturer software version		No
100Bh		Not used		
100Ch	VAR	Guard time	2	No
100Dh	VAR	Life time factor	1	No
100Eh 100Fh		Not used		
1010h	ARRAY	Store parameters		No
1011h	ARRAY	Restore default parameters		No
1012h 1013h		Not used		
1014h	VAR	COB ID emergency object	4	No
1015	VAR	Inhibit time EMCY	2	No
1016h	ARRAY	Consumer heartbeat time		No
1017h	VAR	Producer heartbeat time	2	No
1018h	RECORD	Identity object		No
1019h 11FFh		Not used		
1200h 127Fh		Server SDO Parameter		No
1280h 13FFh		Client SDO Parameter		No
1400h 15FF		Receive PDO communication parameters		No
1600h 17FFh		Receive PDO mapping parameters		No
1800h 19FFh		Transmit PDO communication parameters		No
1803h 19FFh		Not used		
1A00h 1BFFh		Transmit PDO mapping parameters		No

Index	Object	Description	Byte	Mapping
2000h	ARRAY	Actual values		No
2001h	ARRAY	Status Hardware		No
2002h	ARRAY	Fault register		No
2003h	ARRAY	Warning register		No
2004h	ARRAY	Operating data		No
2005h 2008h		reserved		
2009h	VAR	local warnings (functional adaptation to Mi)	2	Yes
200Ah	VAR	local errors (functional adaption to Mi)	2	Yes
200Bh 200Fh		Not used		
2010h 20FFh		Event buffer (not accessible over CANopen)		No
2100h	VAR	Current driving data record number	2	Yes
2101h	ARRAY	System parameters		No
2102h	ARRAY	Drive data		No
2103h	ARRAY	Name plate		No
2104h	ARRAY	Hardware information		No
2105h	ARRAY	Reference operation		No
2106h	ARRAY	Bus interface		No
2107h	ARRAY	Control loop		No
2108h 2109h	ARRAY ARRAY	Manual operation 1 Manual operation 2		No
210Ah 21FFh		Not used		
2200h 2203h	ARRAY	Digital inputs		No
2204h 22FFh		Not used		
2300h 2303h	ARRAY	Digital outputs		No
2304h 23FFh		Not used		
2400h	ARRAY	Analogue input		No
2401h 24FFh		Not used		
2500h		analogue output (not implemented)		
2501h 25FFh		Not used		
2600h 2603h	ARRAY	Speed position controller, controller records 1 to 4		No
2604h 26FFh		Not used		
2700h 2763h	ARRAY	Driving data records 1 to 99		No
2764h 27FFh		Not used		
2900h 29FFh		Soft-PLC parameter (not implemented)		

3000h 5FFFh		Not used		

6000h 6006h		Not used		
6007h	VAR	Abort connection option code	2	No
6008h 603Fh		Not used		

Index	Object	Description	Byte	Mapping
6040h	VAR	control word	2	Yes
6041h	VAR	status word	2	Yes
6042h 605Fh		Not used		
6060h	VAR	modes_of_operation	1	Yes
6061h	VAR	modes_of_operation_display	1	Yes
6062h		Nicht verwendet		
6063	VAR	position_actual_value * (functional adaption to Mi)	4	Yes
6064h	VAR	position_actual_value	4	Yes
6065h	VAR	following_error_window	4	No
6066h		Nicht verwendet		
6067h	VAR	position_window	4	No
6068h 606Bh		Not used		
606Ch	VAR	velocity_actual_value	4	Yes
606Dh		Not used		
6070h		Not used		
6071h	VAR	target_torque	2	Yes
6072h	VAR	max_torque	2	No
6073h	VAR	(functional adaption to Mi)	2	No
6074h		Not used		
6075h	VAR	(functional adaption to Mi)	4	No
6076h	VAR	motor_rated_torque	4	No
6077h	VAR	torque_actual_value	2	Yes
6078h		Not used		
6079h	VAR	DC_link_circuit_voltage	4	No
607Ah	VAR	target_position	4	Yes
607Bh		Not used		
607Ch	VAR	home_offset	4	No
607Dh	ARRAY	software_position_limit		No
607Eh	ARRAY	Polarity (functional adaption to Mi)		No
607Fh	VAR	max_profile_velocity	4	Yes
6080h	VAR	max_motor_speed	2	No
6081h	VAR	profile_velocity	4	Yes
6082h		Not used		
6083h	VAR	profile_acceleration	4	No
6084h	VAR	profile_deceleration	4	No
6085h		Not used		
6086h	VAR	motion_profile_type	2	No
6087h 6090h		Not used		
6091h	VAR	(functional adaption to Mi)	1	No
6098h	VAR	homing_method	1	No
6099h	ARRAY	homing_speeds		No
609Ah	ARRAY	homing acceleration		No
609Bh 60F9h		Not used		
60FBh	ARRAY	position_control_parameter_set		No
60FDh	VAR	digital_inputs	4	Yes
60FEh	VAR	digital_outputs (functional adaption to Mi)	1	No
60FFh	VAR	target_velocity	4	Yes
6100h 650Fh		Not used		
6510h	VAR	(functional adaption to Mi)	1	No
6511h 8FFFh		Not used		

4.2 Profile parameter numbers (Device Profile)

In the following, those device-specific parameters are described whose values have special meanings.

4.2.1 1000h device_type

CANopen-specific description of the MDA. The value to be read out is 0002 0192h, which means “servo drive” according to CiA DSP 402.

4.2.2 1001h error register

When an error state occurs, the error register object is updated. If the bit 3 (fault) is set in the status word, the fault number can be queried in this object.

4.2.3 1003h predefined error field

In subindex 1, you can find the number of subindices in which faults are stored. The other subindices include the fault number as listed under index 1001h. Error bits available within the application are translated into CANopen Error codes in accordance with the table below.

Value	Meaning
0000h	Without fault
2300h	Fault Motor
3210h	DC-link circuit above 400V
3220h	DC-link circuit below 180V
3320h	Brake supply voltage not in range from 20V to 28V
4210h	Electronics temperature above 78°C or Temperature Power electronics
4310h	Motor temperature above 140°C
5520h	Fault in the Flash-CRC
5530h	Fault in the EEPROM
6080h	Fault during reference operation
6081h	Fault in driving data record or No reference bit or Fault Input range of the analogue input or Absolute encoder range exceeded
6082h	Run command started during switch-on limit
6083h	Driving data record end Timeout
6320h	Fault in the motor parameters or fault in the system parameters
7112h	Excess current Ballast resistor
7121h	Drive blocked
7500h	Fault Synchronisation Slave or Fault Bus communication
7510h	Connection CAN XC-DSP
7520h	Connection CAN XC-I/OBox
9000h	Quickstop

4.2.4 1008h manufacturer device name

CANopen-specific description of the MDA. The value to be read out is a string with the contents "Milan-Drive A".

4.2.5 1009h manufacturer hardware name

CANopen-specific description of the MDA. The value to be read out is a string with the contents "Z039.652/01“.

4.2.6 100Ah manufacturer software version

CANopen-specific description of the MDA. The value to be read out is a string. The string includes the version of the firmware which is created as follows:

xx**.**xx**-P**xx**.D**xx**.E**xx (with x = 0 – 9)

4.2.7 1011h store parameters

CANopen-specific functions of the MDA.
Use this function to store all parameter settings in the non-volatile EEPROM memory.

The values changed via CANopen are discarded when switching off the MDA or in case of a power failure since they are only stored in the RAM. If the changed parameters are to be retained even after the MDA has been switched off, use this index to save the values before switching off the mains voltage.

From a physical point of view, EEPROM memories possess a lower number of maximum possible write cycles than RAM memories. Therefore, parameter changes should only be stored into the EEPROM if this data is to be maintained even after switching off the MDA.

Consequently, it is recommended to only save data after successful parameterization or prior to disconnecting the voltage.

Subindex	Object	Name	Bytes	Note
1	VAR	Save all parameters	4	
2	VAR	Save Communication parameters	4	
3	VAR	Save application parameters	4	
4	VAR	Save manufacturer defined parameters	4	

To activate the respective function, write the word “SAVE” in ASCII symbols into the register.

MSB LSB

e	v	a	s
65h	76h	61h	73h

4.2.8 1011h restore default parameters

CANopen-specific functions of the MDA.

Subindex	Object	Name	Bytes	Note
1	VAR	Restore Communication + Device Data	4	
2	VAR	Restore Communication Data	4	
3	VAR	Restore Device Data	4	
4	VAR	Restore Manufacturer Data	4	Not implemented

To activate the respective function, write the word “LOAD” in ASCII symbols into the register.

MSB LSB

d	a	o	l
65h	61h	6Fh	6Ch

4.2.9 1018h identity object

CANopen-specific description of the MDA.

Subindex	Object	Name	Bytes	Contents
1	VAR	Vendor-ID	4	00 00 00 04
2	VAR	Product Code	4	12 34 56 78
3	VAR	Revision no.	4	00 01 00 01
4	VAR	Serial no.	4	00 00 00 01

4.2.10 1600h to 1603h Receive PDO mapping parameter

The PDO assignment can be read via sub-index 0. Prior to allow new mapping, the sub-index 0 must be deleted first (overwritten by 9h). Hereafter, the desired objects can be mapped. A mapping example is shown in the "Example" chapter. The standard assignment is detailed in chapter “Process Data Object PDO”.

4.2.11 1A00h to 1A02h Transmit PDO mapping parameter

The PDO assignment can be read via sub-index 0. Prior to allow new mapping, the sub-index 0 must be deleted first (overwritten by 9h). Hereafter, the desired objects can be mapped. A mapping example is shown in the "Example" chapter. The standard assignment is detailed in chapter “Process Data Object PDO”.

4.2.12 6060h modes of operation

Refer to the operational data section.

4.2.13 607Dh software_position_limit

The positions of the software limit switches are set as 32-bit value via the software_position_limit object.

Subindex	Object	Name	Bytes	Meaning
1	VAR	limit [0]	4	Software limit switch positive
2	VAR	limit [1]	4	Software limit switch negative

4.2.14 6086h motion_profile_type

The ramp type of the CANopen-specific operation modes is set as 16-bit value via the motion_profile_type object.

Value	Meaning
-32786 to -1	reserved
0	Linear
1	Sinesquare
2 to 32767	reserved

4.2.15 6098h homing method

For a detailed description refer to the homing mode section.

4.2.16 6099h homing speeds

Subindex	Objekt	Name	Bytes	Bedeutung
1	VAR	speed [0]	4	Output speed reference operation
2	VAR	speed [1]	4	Not used

4.2.17 60FBh position_control_parameter_set

The controller parameters of the CANopen-specific operation modes are set using the position_control_parameter_set object. The ***MDA*** internally uses controller parameter record 4, which can also be defined by 2603h.

Subindex	Object	Name	Bytes	Meaning
1	VAR	velocity-kp	2	Proportional factor output speed
2	VAR	velocity-tn	2	Reset time output speed
3	VAR	position-kp	2	Proportional factor positioning

4.2.18 60FDh digital_inputs

The states of different input functions can be read out as 32-bit double word via the digital_inputs object. The hardware input used for the function is not relevant, but only the set function as such.

Bit	Meaning
00	Hardware limit switch negative
01	Hardware limit switch positive
02	Reference switch
03 – 15	reserved
16	Synchronisation signal
17	Intermediate stop
18	Single step mode
19	Reference start
20	Stop
21	Quick stop
22 – 31	reserved

4.3 Device-specific parameter numbers (Manufacturer Profile)

In the following, the individual device-specific parameter numbers are listed in detail. In the access column, the abbreviations RO for read only and RW for read/write are used.

4.3.1 2000h Actual values

For a detailed parameter description, refer to the "Actual values window" and "Drive information window" sections in the "RS232 Firmware" user manual.
These parameters are described by the system and may not be changed by the user. The user has read access only.

Subindex	Byte	Parameters	Min	Max	Unit	Access
1	2	Torque/Force	–10000	10000	mNm	RO
2	2	Output speed/speed	–8000	8000	rpm	RO
3	4	Position	-2^{31}	$+2^{31}-1$	Inc.	RO
4	2	Error	0	65k	Inc.	RO
5	2	DC-link circuit			*10 V	RO
6	2	24 VDC internal			*10 V	RO
7	2	24 VDC external			*10 V	RO
8	2	Brake voltage			*10 V	RO
9	2	Temperature Electronics			*10 °C	RO
10	2	Temperature Motor			*10 °C	RO
11	2	Temperature Motor controls			*10 °C	RO
12	2	Temperature Ballast			*10 °C	RO
13	2	Active DDR	0	99		RO
14	2	Info status 1				RO
15	2	Info collective fault				RO
16	2	Info collective warning				RO
17	2	Info status 2				RO
18	2	Info drive				RO
19	2	Reserved				
20	2	Reserved				

4.3.1.1 Subindex 14 Info status 1

Bit	Decimal	Description
0	1	Collective warning
1	2	Collective fault
2	4	DDR active
3	8	Setpoint reached (type of setpoint depends on the driving data record type)
4	16	Reference operation active
5	32	Fieldbus active
6	64	Control error
7	128	Intermediate stop during driving data record processing
8	256	Single step mode active
9	512	Single step pause active
10	1024	Reference set
11 - 15	> 2048	reserved

4.3.1.2 Subindex 15 Info collective faults

Bit	Decimal	Comment
0	1	Collective fault Voltage monitoring Uzk
1	2	Collective fault Temperature monitoring
2	4	Collective fault Motor monitoring
3	8	Collective fault LocalCAN monitoring
4	16	Collective fault Fieldbus monitoring
5	32	Collective fault Driving data record processing
6	64	Collective fault Parameters
7	128	Collective fault Logic hardware
8 - 15	> 256	reserved

4.3.1.3 Subindex 16 Info collective warnings

Bit	Decimal	Meaning
0	1	Collective warning Voltage monitoring
1	2	Collective warning Temperature monitoring
2	4	Collective warning Motor monitoring
3	8	Collective warning LocalCAN monitoring
4	16	Collective warning Fieldbus monitoring
5	32	Collective warning Driving data record processing
6	64	Collective warning Parameters
7	128	Collective warning Logic hardware
8 – 15	> 256	reserved

4.3.1.4 Subindex 17 Info status 2

Bit	Decimal	Description
0	1	Stop command is present
1	2	Stop command Rf0 is present
2	4	Quickstop command is present
3	8	Indication of the synchronisation status for Technological function Electric shaft
4 - 15	> 16	reserved

4.3.1.5 Subindex 18 Info drive

Bit	Decimal	Description
0	1	Limit switch in direction of increasing increments
1	2	Limit switch in direction of decreasing increments
2	4	PWM off/on
3	8	reserved
4	16	Control status of the brake
5	32	Control status of the fan
6 - 15	> 64	reserved

4.3.2 2001h Status Hardware

For a detailed parameter description, refer to the "Hardware window" section in the "RS232 Firmware" user manual.

Subindex	Byte	Parameter	List	Min	Max	Default	Access
1	2	Logic variant					RO
2	2	Bus module variant	0=No module available 1= Profibus 2= CANopen				RO
3	2	I/O interface variant	0= No module available 1= Type1				RO
4	2	Number of digital inputs on interface		0	4	4	RO
5	2	Number of digital outputs on interface		0	4	4	RO
6	2	Number of analogue inputs on interface		0	2	1	RO
7	2	Number of analogue outputs on interface		0	2	0	RO
8	2	Status digital inputs					RO
9	2	Status digital outputs					RO
10	2	Status analogue input 1		0	65k	0	RO
11 - 17		Reserved					

4.3.2.1 Subindex 8 Status digital inputs

Bit	Decimal	Description
0	1	Digital input 1
1	2	Digital input 2
2	4	Digital input 3
3	8	Digital input 4
4 - 15	> 16	reserved

4.3.2.2 Subindex 9 Status digital outputs

Bit	Decimal	Description
0	1	Digital output 1
1	2	Digital output 2
2	4	Digital output 3
3	8	Digital output 4
4 - 15	> 16	reserved

4.3.3 2002h Fault register

For a detailed parameter description, refer to the "Drive fault window" section in the "RS232 Firmware" user manual.
Subindices 9 to 16 are currently not assigned. The meanings of the numbers in each subindex are explained in the following tables. The fault numbers are set by the system and will be cancelled after acknowledgement. The user has read access only.

Subindex	Byte	Parameter	Access
1	2	Faults Voltage	RO
2	2	Faults Temperature	RO
3	2	Faults Motor	RO
4	2	Faults LocalCAN	RO
5	2	Faults Fieldbus	RO
6	2	Faults Driving data record	RO
7	2	Faults Parameters	RO
8	2	Faults Logic hardware	RO
9 - 16	2	Fault registers 09 to 16	

4.3.3.1 Subindex 1 Individual fault register 1 (voltages)

Bit	Decimal	Description
0	1	Voltage monitoring DC-circuit link UZK < 180V
1	2	Voltage monitoring DC-circuit link UZK < 400V
2	4	Voltage monitoring Brake
3 - 15	> 8	reserved

4.3.3.2 Subindex 2 Individual fault register 2 (temperatures)

Bit	Decimal	Description
0	1	Temperature monitoring Motor
1	2	Temperature monitoring Electronics
2	4	Temperature monitoring Power electronics
3	8	Temperature monitoring Ballast resistor
4 - 15	> 16	reserved

4.3.3.3 Subindex 3 Individual fault register 3 (motor)

Bit	Decimal	Description
0	1	Resolver signal
1	2	Resolver index
2	4	Encoder signal
3	8	Encoder index
4	16	Synchronisation lost
5	32	reserved
6	64	reserved
7	128	reserved
8	256	reserved
9	512	Fault Motor controls
10	1024	Motor blocked (during resolver adjustment)
11	2048	Number of pole pairs incorrect
12	4096	Motor incorrectly connected
13	8192	Output speed fault
14	16284	Hardware fault
15	32768	Firmware fault

4.3.3.4 Subindex 4 Individual fault register 4 (LocalCAN)

Bit	Decimal	Description
0	1	Connection CAN XC-DSP
1	2	Connection CAN XC-I/OBox
2 – 15	> 4	reserved

4.3.3.5 Subindex 5 Individual fault register 5 (fieldbus)

Bit	Decimal	Description
0	1	Connection monitoring via bus
1	2	Fault in the slave drive (for Technological function Electric shaft)
2 - 15	> 4	reserved

4.3.3.6 Subindex 6 Individual fault register 6 (driving data manager)

Bit	Decimal	Description
0	1	Reference operation fault
1	2	Process driving data record
2	4	Quickstop is performed
3	8	Drive blocked during driving data record
4	16	Switch-on limit active
5	32	Drive does not stop after stop command
6	64	Positioning commands without set reference
7	128	Analogue value outside the valid range
8	256	Range overflow of absolute encoder (APP02.00 and MDAwin02.00)
8 – 15	> 256	reserved

4.3.3.7 Subindex 7 Individual fault register 7 (parameters)

Bit	Decimal	Description
0	1	Fault Motor parameters
1	2	Fault System parameters
2 – 15	> 4	reserved

4.3.3.8 Subindex 8 Individual fault register 8 (logic hardware)

Bit	Decimal	Description
0	1	Fault in the EEPROM
1	2	Fault in the Flash-CRC
2	4	Fault during system start
3 – 15	> 8	reserved

4.3.4 2003h Warning register

For a detailed parameter description, refer to the "Drive warning window" section in the "RS232 Firmware" user manual.
Subindices 9 to 16 are currently not assigned. The meanings of the numbers in each subindex are explained in the following tables.

Subindex	Byte	Parameter	Access
1	2	Warnings Voltage	RO
2	2	Warnings Temperature	RO
3	2	Warnings Motor	RO
4	2	Warnings LocalCAN	RO
5	2	Warnings Fieldbus	RO
6	2	Warnings Driving data manager	RO
7	2	Warnings Parameters	RO
8	2	Warnings Logic hardware	RO
9 - 16	2	Warning registers 09 to 16	

4.3.4.1 Subindex 1 Individual warning register 1 (voltages)

Bit	Decimal	Description
0	1	Voltage monitoring DC-circuit link UZK
1	2	Voltage monitoring Brake
2 – 15	> 4	reserved

4.3.4.2 Subindex 2 Individual warning register 2 (temperatures)

Bit	Decimal	Description
0	1	Temperature monitoring Motor
1	2	Temperature monitoring Electronics
2	4	Temperature monitoring Power electronics
3	8	Temperature monitoring Ballast resistor
4 – 15	> 16	reserved

4.3.4.3 Subindex 3 Individual warning register 3 (motor)

Bit	Decimal	Description
0 – 15	> 1	reserved

4.3.4.4 Subindex 4 Individual warning register 4 (LocalCAN)

Bit	Decimal	Description
0	1	Connection CAN - XC-DSP
1	2	Connection CAN - XC-I/O-Box
2 – 15	> 4	reserved

4.3.4.5 Subindex 5 Individual warning register 5 (fieldbus)

Bit	Decimal	Description
0	1	Connection monitoring via bus
1 – 15	> 2	reserved

4.3.4.6 Subindex 6 Individual warning register 6 (driving data manager)

The warning “limit switch reached” is available from firmware version APP 02.01 and operating software version MDAwin 02.01 and higher.

Bit	Decimal	Description
0	1	Contouring error available
1	2	Global speed limit reached
2	4	Global torque limit reached
3	8	Switch-on limit active
4	16	Range overflow of absolute encoder (APP02.00 and MDAwin02.00)
5	32	Limit switch (positive or negative) reached (APP02.01 and MDAwin02.01)
6 – 15	> 64	reserved

4.3.4.7 Subindex 7 Individual warning register 7 (parameters)

Bit	Decimal	Description
0	1	Warning Motor parameters
1	2	Warning System parameters
2 – 15	> 4	reserved

4.3.4.8 Subindex 8 Individual warning register 8 (logic hardware)

Bit	Decimal	Description
0 – 15	> 1	reserved

4.3.5 2004h Operational data

For a detailed parameter description, refer to the "Operational data window" section in the "RS232 Firmware" user manual. The user has read access only.

Subindex	Byte	Parameter	Unit	Access
1	4	Operation time	Sec	RO
2	4	Motor running time	Sec	RO
3	2	Fault Temp.Elect.		RO
4	2	Fault Temp.Motor		RO
5	2	Fault Temp.PE		RO
6	2	Fault DC-link circuit		RO
7	2	Fault Fieldbus		RO
8	2	Fault Excess current		RO
9	2	Number of restarts		RO

4.3.6 2010h to 20FFh event buffer

This function is not yet available.

Subindex	Byte	Parameter	List	Min	Max	Default	Access
1	2	Event class	0 No entry 1 Fault 2 Warnings 3 Info 4 Write parameters 5 Command 6 System message	0	6	0	
2	2	Event number	event class-dependent - Fault number - Warning number - Info number - Parameter number - Command number - System message number	0	64k	0	
3	1	Date, year		00	99	0	
4	1	Date, month		01	12	0	
5	1	Date, day		01	31	0	
6	1	Time, hour		00	23	0	
7	1	Time, minute		00	59	0	
8	1	Time, second		00	59	0	

4.3.7 2100 h Current driving data record number

The driving data record number, which is processed by the drive at the time of the request, is indicated in this index. The user has read access only.

Subindex	Byte	Parameter	Min	Max	Default	Access
0	2	DDR no.	0	99		RO

4.3.8 2101h System parameters

For a detailed parameter description, refer to the "System window" section in the "RS232 Firmware" user manual.

Sub-index	Byte	Parameter	List	Min	Max	Default	Access
1	1	System type	0=Linear 1=Round shaft/Modulo			Linear	RW
2	1	Display unit Time	0=Second 1=Minute			Minute	RW
3	1	Display unit Position	0=Turn 1=Degree 2=Minute 3=Second 4=Increments 5=m 6=dm 7=cm 8=mm 9=µm			Increments	RW
4	1	Display unit Temperature	0=°C 1=Fahrenheit			°C	RW
5	6,7	Conversion Motor unit	0=Motor turn 1=Gear rotation 2=Increments			Motor turns	RW
6	1	Conversion System unit	0=Turn 1=m 2=dm 3=cm 4=mm 5=µm 6=Degree 7=Minute 8=Second			Turn	RW
7	2	Conversion Motor value		1	65000	1	RW
8	2	Conversion System value		1	65000	1	RW
9	1	Inversion of direction system	0=No 1=Yes			No	RW
10	1	Inversion of direction gear	0=No 1=Yes			No	RW
11	2	Gear factor input		1	1000	1	RW
12	2	Gear factor output		1	1000	1	RW
13		Reserved				0	
14	1	Software limit switch	0=Not activated 1=Activated			Not activated	RW
15	4	Software limit switch negative		-2^{31}	$+2^{31}-1$	0	RW
16	4	Software limit switch positive		-2^{31}	$+2^{31}-1$	0	RW

4.3.9 2102h Drive data

For a detailed parameter description, refer to the "Hardware window" section in the "RS232 Firmware" user manual.

The functions quick stop ramp and quick stop value are available form firmware version APP 02.01 and operating software MDAwin 02.01 and higher.

NOTE

Modifications of the motor data, the motor offset and the UZK correction factor may cause major faults or even a complete failure of the drive.

→ The values may only be changed by the service department of GFC AntriebsSysteme.

Sub-index	Byte	Parameter	List	Min	Max	Default	Unit	Access
1	1	Motor type	0=Not defined 1=MES35 2=MES63 3=MES56			Not defined		RO
2	1	Number of pole pairs	0=Not defined 3-6	0	6	0		RO
3	1	Feedback source	0=Resolver 1=Hyperface			Resolver		RO
4	1	Brake	0=Not available 1=available			Not available		RO
5	1	Fan	0=Not available 1=Continuous 2=Temperature-controlled			Not available		RW
6	1	Reserved						
7	2	Current factor		1000	10000	1750		RO
8	2	Max. torque positive		0	10000	4000	mNm	RW
9	2	Max. torque negative		0	10000	4000	mNm	RW
10	2	Max. speed positive		0	8000	4000	rpm	RW
11	2	Max. speed negative		0	8000	4000	rpm	RW
12	2	Speed limit		0	10000	6000 (1.5*Mspeed)	rpm	RW
13	2	Resolver offset		-1	4095	-1	Inc.	RO
14	2	Align Current		0	65535	1000	mNm	RO
15	2	Align Period		0	65535	1000	ms	RO
16	2	Position ind. impulses		1	65535	4096		RO
17	2	Position holding time		0	65535	0	ms	RW
18	2	Brake apply time		0	5000	40	ms	RO
19	2	Brake release time		0	5000	40	ms	RO
20	2	UZK correction factor		0	1000	90		RO
21	2	Ballast monitoring	0=User defined 1=None 2=internal 3=100W external 4=200W external 5=400W external			2 = internal		RW
22	2	Ballast time constant	(only for P0321 = 0)	0	65535	250		RO
23	2	Ballast fault	(only for P0321 = 0)	0	65535	700		RO
24	2	Max. motor torque		0	10000	4000	mNm	RO
25	2	Max. motor speed		0	8000	4000	rpm	RO
26	2	Quick stop ramp	0=Linear 1=Sinesquare	0	1	0		RW
27	2	Quick stop value		100	65535	65535	rpm/s	RW

4.3.10 2103h Name plate

For a detailed parameter description, refer to the "Name plate window" section in the "RS232 Firmware" user manual.

Subindex	Byte	Parameter	Access
1	20	Commission number	RO
2	20	Product designation	RO
3	20	Serial no motor	RO
4	20	Serial no electr	RO
5	20	Customer designation 1	RO
6	20	Customer designation 2	RO
7	20	Date of final test	RO
8	20	Wiring diagram	RO
9	20	Terminal plan	RO

4.3.11 2104 h Hardware information

For a detailed parameter description, refer to the "Name plate window" section in the "RS232 Firmware" user manual.

Subindex	Byte	Parameter	Access
1	20	FirmwareVersion XC	RO
2	20	FirmwareVersion DSP	RO
3	20	Logic variant	RO
4	20	Interface variant	RO
5	20	Bus module variant	RO
6	20	Power supply unit variant	RO
7	20	Power board variant	RO
8	20	ParameterVersion XC	RO

4.3.12 2105h Reference operation

For a detailed parameter description, refer to the "Reference operation window" section in the "RS232 Firmware" user manual.

The functions Timeout and Next DDR with DDR no. are available from firmware version APP 02.01 and operating software version MDAwin 02.01 and higher.

Sub-index	Byte	Parameter	List	Min	Max	Default	Unit	Access
1	1	Type	0=None 1=Marker 2=Flank 3=Limit switch positive 4=Limit switch negative 5=Block positive 6=Block negative			None		RW
2	1	Start	0=Power up 1=First start 2=Manual 3=Input			Power up		RW
3	1	Behaviour after reference	0=No operation 1=Approach limit switch positive 2=Approach limit switch negative 3=Approach position			None		RW
4	1	Reference traverse	0=positive 1=negative			positive		RW
5	2	Absolute resolver position		-1	4095	-1		RW
6	2	Output speed/speed		-8000	8000	100	rpm	RW
7	2	Torque/Force		0	10000	500	mNm	RW
8	4	Reference offset		-2^{31}	$+2^{31}-1$	0	Incr	RW
9	4	Position after ref operation		-2^{31}	$+2^{31}-1$	0	Incr	RW
10	4	Manual reference position		-2^{31}	$+2^{31}-1$	0	Incr	RW
11	2	Acceleration		100	65535	1000	rpm/s	RW
12	2	Deceleration		100	65535	1000	rpm/s	RW
13	1	Acceleration ramp	0=Linear 1=Sinesquare			Linear		RW
14	1	Deceleration ramp	0=Linear 1=Sinesquare			Linear		RW
15	1	Brake	0=No 1=Yes			Nein		RW
16	1	Reserved						
17	2	Time-out value		0	65535	0	s	RW
18	2	DDR no.		0	99	0		RW
19	2	Reserved						
20	2	Reserved						

4.3.13 2106 h Bus interface

For a detailed description of the parameters, refer to the "MDAwin operating software" section in this manual and to the "Fieldbus window" section in the "RS232 Firmware" user manual.

Sub-index	Byte	Parameter	List	Min	Max	Default	Access
1	1	Type	0=None 1=Profibus 2=CanOpen 3=DeviceNet			None	RO
2	1	Bus termination	0=No 1=Yes			No	
3	2	Slave address		0	255	2	RW
4	2	Baud rate				0	
5	2	Operation mode				0	
6	1	Diagnosis	0=Off 1=On			Off	
7	1	Disable fieldbus access	0=No 1=Yes			No	
8	1	Rights	0=Read only 1=Change DDR 2=Service, no bus changes 3=Everything can be changed			0	
9	48	Reserved					

4.3.14 2107h Control loop

For a detailed parameter description, refer to the "Control loop window" section in the "RS232 Firmware" user manual.
These parameters are adapted to the mounted motor in the factory and cannot be changed by the user. The user has read access only.

NOTE

Modifications of the controller settings may cause major faults or even a complete failure of the drive.

→ The values may only be changed by the service department of GFC AntriebsSysteme.

Sub-index	Byte	Parameter	Min	Max	Default	Unit	Access
1	2	Field-P amplification (KP)	1	65535	5000	1000th	RO
2	2	Field-P scaling	–1000	1000	1		RO
3	2	Field-I reset time (TN) (µs)	0	65535	5000	10ys	RO
4	2	Field-I scaling	–1000	1000	1		RO
5	2	Torque-P amplification (KP)	1	65535	5000	1000th	RO
6	2	Torque-P scaling	–1000	1000	1		RO
7	2	Torque-I reset time (TN) (µs)	0	65535	5000	10ys	RO
8	2	Torque-I scaling	–1000	1000	1		RO

4.3.15 2108h, 2109h Manual operation 1 and 2

The push-to-run driving data records 101 and 102 (manual operation 1 and 2) enable changing the parameters for manual operation and are described in detail in the "Manual operation window" section in the "User Manual RS232 Firmware".

The CANopen profile stipulates that the manual operation has only limited options. Therefore not all parameters which can be changed via the "Manual operation" window in the MDAwin software are available via CANopen. When starting up the state machine, a default setting is made for the manual operation driving data records. The "Stop with maintain position" feature is preset and cannot be changed at a later date.

Sub-index	Byte	Parameter	List	Min	Max	Default	Unit	Access
1	1	Controller type	0=None 1=Torque 2=Output speed 3=Absolute position 4=Relative position 5=Modulo position 6=Contouring error			None		RW
2	4	Nominal value		-2^{31}	$+2^{31}-1$	0	type dep.	RW
3	2	Max. torque		0	10000	500	mNm	RW
4	2	Max. output speed		0	8000	4000	rpm	RW
5	2	Nominal speed for position control		0	8000	3000	rpm	RW
6	2	Acceleration value		100	65535	1000	rpm/s	RW
7	2	Deceleration value		100	65535	1000	rpm/s	RW
8	1	Acceleration ramp	0=Linear 1=Sinesquare	0	1	Linear		RW
9	1	Deceleration ramp	0=Linear 1=Sinesquare	0	1	Linear		RW

4.3.16 2200h to 2203h Digital inputs

For a detailed parameter description, refer to the "I/O drive window" section in the "RS232 Firmware" user manual.

Sub-index	Byte	Parameter	List	Min	Max	Default	Access
1	1	Module address	0=Not assigned 1=Interface 2=Reserved			Not assigned	RW
2	1	Input number		0	255	Not assigned	RW
3	1	Feature	Bit00=Active High/Low Bit01=In combination with DDR Bit02-07=Reserved			1	RW
4	1	DDR no.	DDR no.	0	99	0	RW
5	2	Function	0=None 1=Synchronisation 2=GOTOxx 3=Intermediate stop 4=Single step 5=Set reference point 6=Start reference 7=Start/stop 8=Hardware limit switch negative 9=Hardware limit switch positive 10=Stop with RF0 ramp 11=Quickstop 12=Power amplifier off 13=Start driving data record 14=Stop driving data record 15=Teach in 16=Reset error	0	16	None	RW

4.3.17 2300h to 2303h Digital outputs

For a detailed parameter description, refer to the "I/O drive window" section in the "RS232 Firmware" user manual.

Sub-index	Byte	Parameter	List	Min	Max	Default	Access
1	1	Module address	0 = Not assigned 1 = Interface 2 = Reserved			Not assigned	RW
2	1	Output number		0	255	Not assigned	RW
3	1	Feature	Bit00=Active High/Low Bit01=In combination with DDR Bit02-07=Reserved			1	RW
5	1	DDR no.	DDR no.	0	99	0	RW
6	2	Function	Number of the status bit	0	646	None	RW

4.3.18 2400h Analogue input

For a detailed parameter description, refer to the "I/O drive window" section in the "RS232 Firmware" user manual.

Sub-index	Byte	Parameter	List	Min	Max	Default	Access
1	1	Module address	0=Not assigned 1=Interface 2=Reserved			Not assigned	RW
2	1	Input number		0	255	Not assigned	RW
3	1	Feature	Bit00=Inverse signal Bit01=Fault hardware range yes/no Bit02-D07=Reserved				RW
4	1	Function	0=None 1=Output speed setpoint 2=Torque setpoint 3=Speed limit 4=Torque limit			None	RW
5	2	Function value min.		-32k	+32k	0	RW
6	2	Function value max.		-32k	+32k	0	RW
7	2	Interface value min.		-32k	+32k	0	RW
8	2	Interface value max.		-32k	+32k	0	RW
9	2	Input type	0=None 1= -10 ... +10V 2=Reserved			None	RW

4.3.19 2600h to 2603h Speed position controller, controller record 1 to 4

For a detailed parameter description, refer to the "Speed position controller window" section in the "RS232 Firmware" user manual.

Sub-index	Byte	Parameter	Min	Max	Default	Unit	Access
1	2	Output speed P-amplification (KP)	1	65535	5000	1000th	RW
2	2	Output speed P-scaling	-1000	1000	1		RO
3	2	Output speed I reset time (TN) (µs)	0	65535	5000	10ys	RW
4	2	Output speed I-scaling	-1000	1000	1		RO
5	2	Position P-amplification (KP)	1	65535	5000	1000th	RW
6	2	Pilot control	0	65535	1		RW
7	2	Positioning window	0	30000	10		RW
8	2	Contouring error window	0	30000	10000		RW
9	2	Driving data record end window	0	30000	5		RO

4.3.20 2700h to 2763h Driving data records

Use parameters 2700h to 2763h to program the driving data records in the same way as via the "DDR editor" window in the ***MDAwin*** operating software. For information on the individual parameters, please refer to the "DDR editor window" section in the "User Manual RS232 Firmware".

Sub-index	Byte	Parameter	List	Min	Max	Default	Unit	Access
1	1	Controller type	0=None 1=Torque 2=Output speed 3=Absolute position 4=Relative position 5=Modulo position 6=Contouring error			None		RW
2	1	Feature	Bit00=Synchronisation Bit01=Nominal value externally allowed Bit02=Stop with position dwell time Bit03=Stop with brake Bit04=Intermediate stop without current Bit05=Speed limitation Bit06-07=Reserved			Not active No No No No No 0		RW
3	4	Nominal value		-2^{31}	$+2^{31}-1$	0	type dep.	RW
4	4	Target time		0	$+2^{32}$	0	ms	RW
5	2	Torque		0	10000	500	mNm	RW
6	2	Maximum speed		0	8000	4000	rpm	RW
7	2	Nominal speed for position control		0	8000	3000	rpm	RW
8	2	Acceleration value		100	65535	1000	rpm/s	RW
9	2	Deceleration value		100	65535	1000	rpm/s	RW
10	4	Holding time (ms)		0	1000000	0	ms	RW
11	1	Acceleration ramp	0=Linear 1=Sinesquare	0	1	Linear		RW
12	1	Deceleration ramp	0=Linear 1=Sinesquare	0	1	Linear		RW
13	1	Driving data record linking	0=None 1=Overhung 2=Maintain position 3=Brake 4=Without power	0	99	None		RW
14	1	Next DDR		0	99	0		RW
15	1	Controller parameter record		1	4	1		RW
16	1	Program identification		0	99	0		RW

4.3.21 2900h to 29FFh Soft PLC

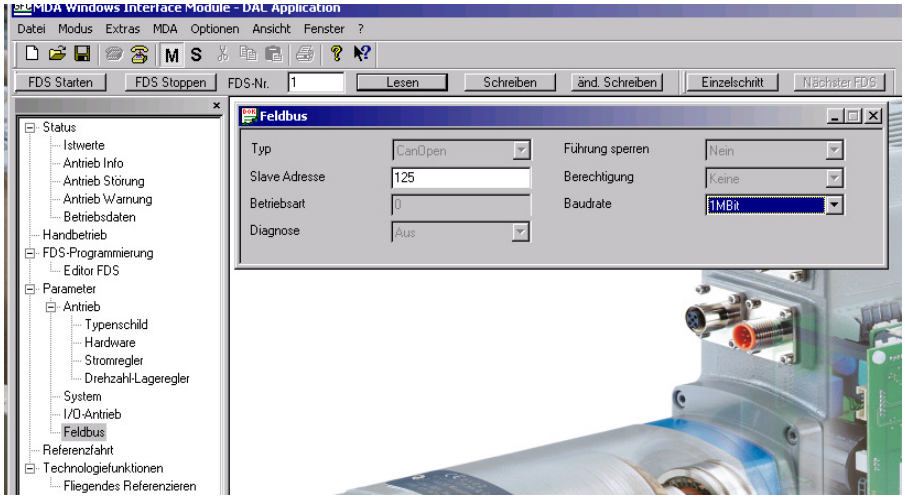
This function is not yet available.

Subindex	Bytes	Parameter	Min	Max
1	1	Operator		
2	1	Reserved		
3	2	Input-1		
4	2	Input-2		
5	2	Input-3		
6	2	Input-4		
7	2	Output		

5 MDAwin operating software

For a detailed description of the ***MDAwin*** operating software refer to the "MDAwin operating software" section in the "RS232 Firmware" user manual.

5.1 Settings in the Fieldbus window



Type The bus module included within the drive is automatically detected and displayed, if there is a connection to the drive available (online).

Slave address The address of the slave (0...127) is entered in this field. An address may be assigned only once within a segment.
The address 125 is preset on delivery.

Operation mode This function is not yet available via CANopen. When using an ***MDA*** with CANopen interface, the operation modes are set via parameters. For more detailed information, refer to section 3, "CANopen" of the present manual.

Diagnosis This function has not yet been implemented.

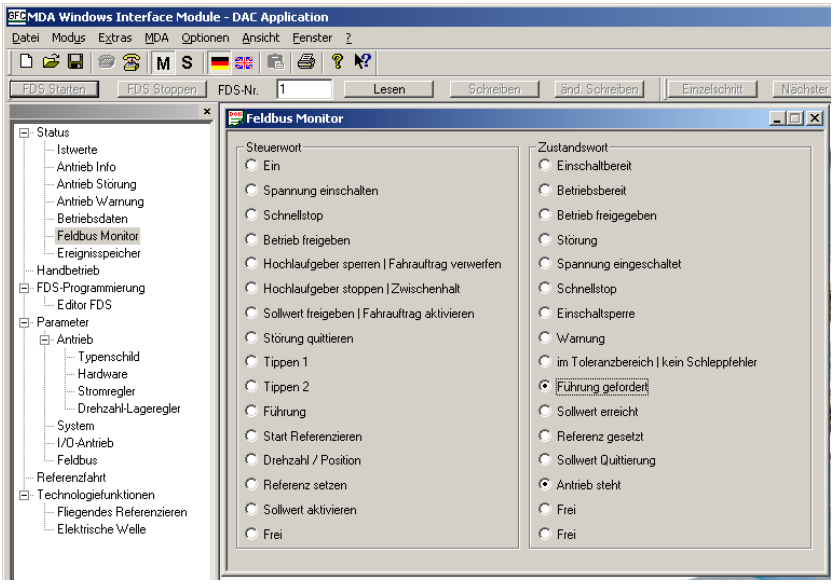
Disable fieldbus access This function has not yet been implemented.

Rights The CANopen interface of the ***MDA*** is definitely set to access level 4 Planner (refer to online level 4 for ***MDAwin***).

Baud rate The setting is based on the baud rate used in the network into which the ***MDA*** is to be integrated.

5.2 Fieldbus monitoring window

This function is available from firmware version APP 02.04 and operating software version MDAwin 02.04 and higher.



This window displays the control and state word of a drive equipped with fieldbus interface. For this, there must be an active connection to the drive. The update is carried out at the same frequency as the update of other displays, like speed or position. No indication can be made on transient procedures via the fieldbus monitor. This window is used to commission a drive with fieldbus interface.

6 Electrical connection

DANGER

Hazardous voltages at the control and power connections even if the drive is at a standstill.

Electric shock risk

→ Disconnect all wires of the connected control and power cables – also those which are not required – at the respective terminals in the control cabinet and protect them against direct contact.

→ It is not permitted by any means to just to cut the connecting cables at the unassembled end.

6.1.1 Plug wiring

For a detailed plug wiring description, refer to the "Electrical connection" section in the "RS232 Firmware" user manual.

6.1.2 Cable sets

For a detailed cable set description, refer to the "Electrical connection" section in the "RS232 Firmware" user manual.

7 Examples

Below there are two examples for starting up the state machine.

7.1 SDO telegram exchange

In the task telegrams (M – S), the * in the COB ID or the data field has to be replaced by the node address of the slave; the ** in the data field has to be replaced by the respective operation mode.

network management		COB ID	CB	Index		Subindex	data	data
start node	M - S	0					01	*
	S - M	18*					40	00

state machine		COB ID	CB	Index		Subindex	data	data
request remote control	M - S	60*	2B	40	60	00	00	80
	S - M	58*	60	40	60	00	00	00
	S - M	18*	00	00	00	00	40	02
start	M - S	60*	2B	40	60	00	06	80
	S - M	58*	60	40	60	00	00	00
	S - M	18*	00	00	00	00	21	02
switch on	M - S	60*	2B	40	60	00	07	80
	S - M	58*	60	40	60	00	00	00
	S - M	18*	00	00	00	00	23	02
enable operation	M - S	60*	2B	40	60	00	0F	80
	S - M	58*	60	40	60	00	00	00
	S - M	18*	00	00	00	00	27	02

Operation mode		COB ID	CB	Index		Subindex	data	data
modes_of_operation	M - S	60*	2F	60	60	00	**	00
	S - M	58*	60	60	60	00	00	00
	S - M	282	00	00	00	00	**	00

7.2 PDO telegram exchange

The * in the COB ID has to be replaced by the respective node address of the slave.

state machine		COB ID	CB	Index		Subindex	data	data
request remote control	M - S	20*	00	00	00	00	00	80
	S - M	18*	00	00	00	00	40	02
start	M - S	20*	00	00	00	00	06	80
	S - M	18*	00	00	00	00	21	02
switch on	M - S	20*	00	00	00	00	07	80
	S - M	18*	00	00	00	00	23	02
enable operation	M - S	20*	00	00	00	00	0F	80
	S - M	18*	00	00	00	00	27	02

7.3 State machine for speed control

		COB-ID	data	data	data	data	data	data	data	data
Start node	M – S	0	01	*						
	S - M	18*	40	00						
request remote control	M - S	20*	00	80						
	S - M	18*	40	02						
shutdown	M - S	20*	06	80						
	S - M	18*	21	02						
switch on	M - S	20*	07	80						
	S - M	18*	33	02						
enable operation	M - S	20*	0F	80						
	S - M	18*	37	02						
Activate halt	M – S	20*	0F	81						
	S - M	18*	37	07						
Define the mode of operation	M - S	30*	03							
	S - M	28*	03							
Define the setpoint	M - S	60*	23	FF	60	00	B8	0B	00	00
	S - M	58*	60	FF	60	00	00	00	00	00
Start the drive	M – S	20*	0F	80						
	S – M	18*	37	02						
Stop the drive	M - S	20*	0F	81						
	S – M	18*	37	07						

7.4 State machine for position control

		COB-ID	data	data	data	data	data	data	data	data
Start node	M – S	0	01	*						
	S - M	18*	40	00						
request remote control	M - S	20*	00	80						
	S - M	18*	40	02						
shutdown	M - S	20*	06	80						
	S - M	18*	21	02						
switch on	M - S	20*	07	80						
	S - M	18*	33	02						
enable operation	M - S	20*	0F	80						
	S - M	18*	37	02						
halt aktivieren	M – S	20*	0F	81						
	S - M	18*	37	07						
Define the mode of operation	M - S	30*	01							
	S - M	28*	01							
Define the setpoint	M - S	60*	23	7A	60	00	50	C3	00	00
	S - M	58*	60	7A	60	00	00	00	00	00
transition	M – S	20*	1F	81						
	S – M	18*	37	12						
Start the drive	M – S	20*	1F	80						
	S – M	18*	27	02						
Stop the drive	M - S	20*	0F	81						
	S – M	18*	27	07						

7.5 PDO mapping

		COB-ID	data	data	data	data	data	data	data	data
Deactivating the PDO			CB	Index		Sub-index				
	M - S	60*	2F	00	16	00	00			
	S - M	58*	60	00	16	00	00			

Setting new Objects

	M - S	60*	23	00	16	°	10	00	°°
	S - M	18*	60	00	16	°	00		

Instead of * the concerning node address has to be written.
Instead of ° the concerning subindex has to be written. The objects habe to be mapped into the PDO by starting with subindex 0 of the PDO.
Instead of °° the concerning object has to be written.
Repeat this step according tot he number of objects that shall be mapped.

Activating the PDO

	M - S	60*	2F	00	16	00	**
	S - M	18*	40	00			

Instead of ** the number of objects mapped has to be written.

8 Literature

8.1 MDA user manuals

1. Short instructions
   Order no.: Y004.135

2. User manual RS232 Firmware
   Order no.: Y003.804

3. Dimension sheet
   Order no.: Y003.805
   (2D and 3D-CAD data of the MDA for common CAD systems can be ordered from GFC AntriebsSysteme)

4. Technical data
   Order no.: Y003.806

5. Interface description PROFIBUS DP
   Order no.: Y004.011

6. Interface description CANopen
   Order no.: Y004.013

7. Functional block description S7 functional blocks for Profibus DP
   Order no.: Y004.012

8. Functional block description PLC function blocks for CANopen
   Order no.: Y004.014

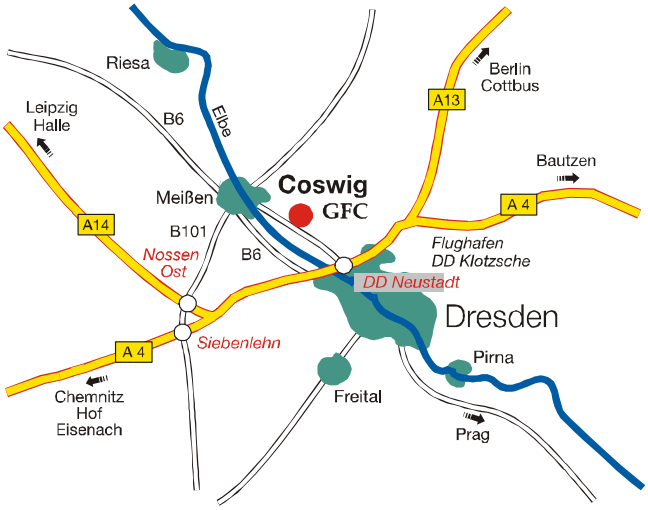
9. Operation instructions Operation box PV 1608
   Order no.: Y004.010

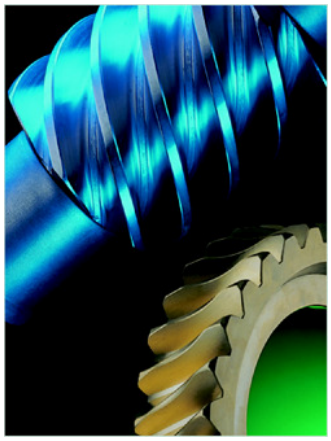
8.2 Further literature

1. As an introduction to CAN:
Wolfhard Lawrenz: CAN Controller Area Network Grundlagen und Praxis
Hüthig Verlag, ISBN 3-7785-2734-7

2. CANopen:
CANopen Application Layer and Communication Profile, CiA Draft Standard 301
Available from: CAN in Automation e.V.
http://www.can-cia.org

3. CANopen Profile:
CANopen Device Profile for Drives and Motion control, CiA Draft Standard Proposal 402
Available from: CAN in Automation e.V.
http://www.can-cia.org





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